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## **EAST AFRICAN STANDARD**

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**Retro-reflective registration plates for motor vehicles —  
Specification — Part 4: Plastics**

**EAST AFRICAN COMMUNITY**

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## Foreword

Development of the East African Standards has been necessitated by the need for harmonizing requirements governing quality of products and services in East Africa. It is envisaged that through harmonized standardization, trade barriers which are encountered when goods and services are exchanged within the Community will be removed.

In order to meet the above objectives, the EAC Partner States have enacted an East African Standardization, Quality Assurance, Metrology and Test Act, 2006 (EAC SQMT Act, 2006) to make provisions for ensuring standardization, quality assurance, metrology and testing of products produced or originating in a third country and traded in the Community in order to facilitate industrial development and trade as well as helping to protect the health and safety of society and the environment in the Community.

East African Standards are formulated in accordance with the procedures established by the East African Standards Committee. The East African Standards Committee is established under the provisions of Article 4 of the EAC SQMT Act, 2006. The Committee is composed of representatives of the National Standards Bodies in Partner States, together with the representatives from the private sectors and consumer organizations. Draft East African Standards are circulated to stakeholders through the National Standards Bodies in the Partner States. The comments received are discussed and incorporated before finalization of standards, in accordance with the procedures of the Community.

Article 15(1) of the EAC SQMT Act, 2006 provides that "Within six months of the declaration of an East African Standard, the Partner States shall adopt, without deviation from the approved text of the standard, the East African Standard as a national standard and withdraw any existing national standard with similar scope and purpose".

East African Standards are subject to review, to keep pace with technological advances. Users of the East African Standards are therefore expected to ensure that they always have the latest versions of the standards they are implementing.

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# Retro-reflective registration plates for motor vehicles — Specification — Part 4: Plastics

## 1 Scope

This standard specifies requirements for plastic number plates that are intended for use on motor vehicles and trailers.

## 2 Normative references

The following referenced documents are indispensable for the application of this East African Standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ASTM G 154a, *Standard practice for operating fluorescent light apparatus for UV exposure of nonmetallic materials*

CIE 15.2, *Colorimetry*

CIE 54.2, *Retro-reflection: Definition and measurement*

ISO 2813, *Paints and varnishes — Determination of specular gloss of non-metallic paint films at 20°, 60° and 85°*

## 3 Definitions

For the purposes of this standard, the following definitions apply:

### 3.1

#### **blank**

flat plastic transparent plate of a size specified in 4.2, for the use in the manufacture of a number plate

### 3.2

#### **illuminants A and D65**

as defined by the International Commission on Illumination (CIE 15.2)

### 3.3

#### **luminance factor**

ratio of the luminance of the material to that of a perfect reflecting diffuser identically illuminated

### 3.4

#### **licence number**

combination of non-self-radiating letters and numerals as prescribed by the National Road Traffic Act (Act 93 of 1996)

### 3.5

#### **number plate**

plate that displays the licence number of a motor vehicle or trailer

### 3.6 retro-reflection

reflection in which light is reflected in directions close to the direction of incidence, irrespective of the angle of incidence at the reflecting surface

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## 4 Requirements

### 4.1 Materials

#### 4.1.1 Blanks

A blank shall be manufactured from transparent UV stable plastic material, that has a surface specular gloss of at least 80 at 60° when measured in accordance with ISO 2813. The thickness of the blank shall be between 3.0 mm and 4.0 mm.

The blank shall be manufactured through an injection moulding process and shall bear the manufacturer's name or trade mark in the top right corner which shall be part of the moulding process.

#### 4.1.2 Retro-reflective material

The colour of retro-reflective material for number plates shall be yellow, white, or white with graphics and shall bear a validation mark that identifies the manufacturer of the material. The retro-reflective material shall be such that when it is applied to a blank, the colour, luminance factor and coefficients of retro-reflection of the plate comply with the relevant requirements of 4.1.2.1 and 4.1.2.2.

##### 4.1.2.1 Colour and luminance factor

**4.1.2.1.1** When determined in accordance with 5.3, the colour of the retro-reflective material, without graphic, shall be yellow or white and the chromaticity co-ordinates shall be within the area on a chromaticity diagram defined by the lines connecting the points of the appropriate values given in Table 1.

**4.1.2.1.2** The retro-reflective material with graphics shall be tested as specified in 5.3.

**4.1.2.1.3** When determined in accordance with 5.3, the luminance factor of the retro-reflective material, without graphic, shall be at least the appropriate value given in Table 1.

**Table 1 — Chromaticity co-ordinates and luminance factors**

1	2	3	4	5	6	7
Colour	Co-ordinate	Value of co-ordinate				Luminance factor min.
Yellow	x	0.545	0.487	0.427	0.465	0.27
	y	0.454	0.423	0.483	0.534	
White	x	0.355	0.305	0.285	0.335	0.35
	y	0.355	0.305	0.325	0.375	

##### 4.1.2.2 Coefficients of retro-reflection

When the coefficients of retro-reflection of the material (with graphic if provided) are determined in accordance with 5.4, they shall be at least the relevant values given in Table 2.

**Table 2 — Coefficients of retro-reflection**

1	2	3	4	5
Observation angle	Entrance angle	Coefficient of retro-reflection when measured with standard illuminant A		
degrees	degrees	cd/(lx.m <sup>2</sup> ) min.		
		Graphic	Yellow	White
0.33 <sup>a)</sup>	5 <sup>a)</sup>	35	35	50
2	30	1.5	1.5	2.5

<sup>a)</sup> The coefficient of retro-reflection at an angle of observation and an entrance angle of 0.33° and 5° respectively, shall not exceed 100cd/(lx.m<sup>2</sup>) for yellow material and 160 cd/(lx.m<sup>2</sup>) for white material.

<sup>b)</sup> The total retro-reflection per unit area of a full number plate including graphics without characters. Graphics shall be printed on a white retro-reflective material and shall have a retro-reflective value as given in Table 2, column 3.

#### 4.1.2.3 Markings of retro-reflective material

The retro-reflective material shall bear a legible and indelible validation mark that forms an integral part of the material that identifies the manufacturer of the material, and the manufacturer's batch number and the year of manufacture. The validation mark shall not interfere with the legibility of the number plate. A provincial identity may also be incorporated as above.

#### 4.2 Shape and dimensions

Number plates shall be rectangular, with corners rounded to a radius of 15 mm  $\pm$ 2 mm, be free from sharp edges and burrs, and shall be of one of the following sizes:

- a) 440 mm ( $\pm$  1 mm)  $\times$  120 mm ( $\pm$  1 mm);
- b) 250 mm ( $\pm$  1 mm)  $\times$  205 mm ( $\pm$  1 mm);
- c) 520 mm ( $\pm$ 1 mm)  $\times$  111.5 mm ( $\pm$  1.5 mm);
- d) 305 mm ( $\pm$  1 mm)  $\times$  165 mm ( $\pm$  1 mm); or
- e) 250 mm ( $\pm$  1 mm)  $\times$  165 mm ( $\pm$  1 mm). (Permitted for category "L" motor vehicles only.)

#### 4.3 Licence number, border and graphic

##### 4.3.1 Colour and luminance factor

###### 4.3.1.1 Colour

The licence number and the border shall be black, blue, red or green.

###### 4.3.1.2 Luminance factor

When the luminance factor of the colours black, blue, red or green is determined in accordance with 5.3, it shall not exceed 0.07.

##### 4.3.2 Shape and dimensions of characters of registration numbers

Dependent upon the registration plate size, the number of characters in the licence number and the height of the characters, the form and dimensions of the characters of the licence number shall be as prescribed in 4.3.2.1 for 75 mm high characters, or 4.3.2.2 for 60 mm high characters.

###### 4.3.2.1 The 75 mm high characters of a licence number

The characters of a number plate shall be such that the characters consist of:

- a) not more than nine characters in one line on a plate of size 520 mm  $\times$  113 mm (see figure 4(b)); or
- b) not more than nine characters in one line on a plate of size 440 mm  $\times$  120 mm (see figure 4(a)); or
- c) characters in two lines on a plate of size 250 mm  $\times$  205 mm (see figure 4(c)), and

shall be of height 75 mm  $\pm$ 1.0 mm and shall have shapes that conform to those of the appropriate characters given in figure 1 or figure 2.

###### 4.3.2.2 The 60 mm high characters of a licence number

The characters of a licence number, shall be such that the characters consist of:

- a) not more than five characters in two lines on a plate of size 305 mm  $\times$  165 mm (see figure 4(e)), or

b) not more than four characters in two lines on a plate of size 250 mm x 165 mm (see figure 4(d)), and shall be of height 60 mm  $\pm$ 1,0 mm and, shall have shapes that conform to those of the appropriate characters given in figure 3.

#### **4.3.3 Setting out of the characters of a licence number**

The characters shall be placed as follows:

- Width of space between adjacent characters and graphics, not of a background graphic: 10 mm min.
- Width of spaces between outside edges of plate and the first and last character: 15 mm min.
- Width of space between rows of characters on a plate that bears a double row of characters: 10 mm  $\pm$  1 mm.
- Width of space that separates adjacent groups of letters and numerals: 10 mm min.
- Width of space between adjacent letters in groups of letters and width of space between adjacent numbers in groups of numbers shall be equal, subject to a tolerance of  $\pm$  1 mm.

#### **4.3.4 Border**

The border of a plate shall be as shown in Figure 5 and shall extend around the four sides of the plate.

#### **4.3.5 Graphics**

Graphics shall be of not more than four colours and shall not negatively affect the legibility of the licence number or be of such design as to be mistaken for a letter or numeral.

#### **4.3.6 Workmanship**

**4.3.6.1** The retro-reflective material, licence number and border of a plate shall be free from creases, chips, blisters, discolouration and spots.

**4.3.6.2** The licence number shall be clearly defined.

**4.3.6.3** A plate shall be of such flatness that, when it is laid (with the licence number upwards) on a flat supporting surface, no part of the lower surface of the plate is more than 3 mm from the supporting surface.

#### **4.4 Luminance factor ratio of colours**

When determined in accordance with 5.3, the ratio of the luminance factor values between the character colour and the adjacent retro-reflective background, and if applicable, between the character colour and adjacent graphic background colour, shall not be less than 5:1.

#### **4.5 Performance**

##### **4.5.1 Resistance to weathering**

When tested in accordance with 5.5

- a) the chromaticity co-ordinates shall remain within the area on the appropriate chromaticity diagram as defined in Table 1,
- b) the coefficient of retro-reflection at an angle of observation and an entrance angle of 0.33° and 5° respectively, shall be at least 80 % of the minimum values given in Table 2, and

- c) when viewed from a distance of approximately 250 mm under a standard light source, providing 400 lx, the retro-reflective material shall show no sign of cracking, blistering or loss of adhesion that would affect the functionality of the plate.

#### 4.5.2 Resistance to impact

When tested in accordance with 5.6, and where applicable, the retro-reflective material, character, border and the base material shall show no cracking or separation from the substrate outside a distance of 5 mm from the impacted area.

#### 4.5.3 Resistance to scratching

When tested in accordance with 5.7 the scratch produced on the protective cover of the specimen shall not have penetrated the protective cover.

#### 4.5.4 Resistance to bending

When a plate is tested in accordance with 5.8 and the front surface is examined from a distance of 250 mm, there shall be no visible cracking or loss of adhesion of the retro-reflective material, the licence number or border, or similar defects that would affect the functionality of the plate.

## 5 Inspection and methods of test

### 5.1 Inspection

Visually examine and then measure each plate in the sample for compliance with all the relevant requirements for which tests to assess compliance are not given in 5.3 to 5.8 (inclusive).

### 5.2 Test specimens

From the sample number plates, cut the following test specimens:

- a) **resistance to weathering:** one complete number plate;
- b) **resistance to impact:** one complete number plate;
- c) **resistance to scratching:** one test specimen each of width 50 mm;
- d) **resistance to bending:** one complete number plate with a tolerance of (+0-2) mm, and of length 110 mm with a tolerance of (+ 0-1) mm, bearing where applicable;
  - retro-reflective material only,
  - the surface coating of the characters and border.

### 5.3 Colour and luminance factor test

#### 5.3.1 Chromaticity co-ordinates and luminance factors

Determine the chromaticity co-ordinates and luminance factors of the relevant areas of the specimen by means of a spectrophotometer or other equally suitable colour measuring device in accordance with CIE 15.2, using standard illuminant D65 and 45/0 geometry. Check for compliance with 4.1.2.1, 4.3.1.2 and 4.4.

#### 5.3.2 Graphics

Select specimens of size 70 mm × 45 mm from those areas of graphics of the plate that may affect the legibility of the licence number. Determine the luminance factor by means of a spectrophotometer or other equally suitable colour measuring device in accordance with CIE 15.2, using standard illuminant D65 and 45/0 geometry. Check for compliance with 4.3.1.2 and 4.4.

## 5.4 Photometric test

### 5.4.1 Test specimens

- a) White and yellow plates: Test panel of size 70 mm × 150 mm.
- b) Plate with graphics: Full plate divided length-wise into 3 equal sized sections.

### 5.4.2 Method

Determine the coefficients of retro-reflection in accordance with CIE 54.2, using the values of observation angle and entrance angle given in table 2. On each specimen, take the average of two readings at rotation angles (about the reference axis) that are 90° apart. In the case of plates with graphics, calculate the total retro-reflection of the three sections and express as candelas (lux·m<sup>2</sup>). Check for compliance with 4.1.2.2.

## 5.5 Resistance to weathering

Mount the specimen (see 5.2(a)) with the test surface facing the lamps, and subject it to artificial weathering using the apparatus and method given in ASTM G 154a for 240 h using a cycle of 4 h UV exposure at 60 °C and then 4 h condensation exposure at 50 °C. Check for compliance with 4.5.1 after completion of the test.

## 5.6 Resistance to impact

### 5.6.1 Apparatus

**5.6.1.1 Striker:** a steel ball of diameter 25 mm.

**5.6.1.2 Base:** a solid support base such as concrete or a steel plate of thickness 12.5 mm.

### 5.6.2 Procedure

**5.6.2.1** Place the specimen (see 5.2(b)), with the protective cover facing upwards, on the base that the striker will fall onto a central section of the specimen.

**5.6.2.2** Raise the striker 2 m above the specimen and allow it to fall.

**5.6.2.3** Repeat 5.6.2.1 and 5.6.2.2, but with the point of impact, being on part of the surface of a character.

**5.6.2.4** Examine the specimen for compliance with 4.5.2.

## 5.7 Resistance to scratching

### 5.7.1 Apparatus

**5.7.1.1 Needle and arm:** a needle with a hardened steel hemispherical point of diameter 1 mm, fixed vertically, point downwards, to the end of a counterpoised horizontal arm. The horizontal arm provides for the loading of mass-pieces above the needle direct, and it may be set in equilibrium on its fulcrum by adjustment of the counter-mass before mass-pieces are loaded above the needle.

**5.7.1.2 Mass-pieces:** a set of thirty 50 g mass-pieces.

**5.7.1.3 Base with sliding specimen holder:** a sliding specimen holder that moves freely and automatically on its base under the loaded needle (which is perpendicular to the specimen holder).

### 5.7.2 Procedure

**5.7.2.1** Set the horizontal arm in equilibrium, clamp the specimen (see 5.2(c)) to the specimen holder, with the protective cover to be tested facing upwards. Load the needle with 30 mass-pieces (i.e. to a total mass of 1 500 g) and lower the needle carefully onto the material surface while starting to slide the holder.

Alternatively, put the end of the needle on a razor blade on the material surface that the needle can slide off the sharp edge of the blade onto the surface. Slide the holder at a uniform speed of approximately 30 mm/s for a distance of about 90 mm.

**5.7.2.2** Examine the edges of the groove under 10X magnification.

**5.7.2.3** Check for compliance with the relevant requirements of 4.5.3.

**5.7.2.4** Repeat 5.7.2.1 to 5.7.2.3 on two other parts of the material surface.

## **5.8 Resistance to bending**

Place the protective cover side of the number plate against a mandrel of diameter 75 mm  $\pm$  1 mm that the line of maximum bending coincides with the vertical centre-line of a letter or numeral. Taking about 3 s, bend the specimen through an angle of  $90^\circ \pm 2^\circ$  over the mandrel, and then examine it for compliance with 4.5.4. Immediately following this procedure, and taking about 3 s, so bend the specimen back through the same angle that it is in approximately its original alignment and again examine it for compliance with 4.5.4.

## **6 Packing**

The plates shall be packed so as to ensure that they are not damaged during normal handling, transportation and storage.

## **7 Marking**

**7.1** No marking other than the licence number, the graphic (when applicable), the marking required in terms of 4.1.2.3, 7.2, 7.3, 7.4 and the border shall appear on the front surface of a number plate. These markings shall not interfere with the legibility of the licence number.

**7.2** The front surface of the plate shall bear, in legible and indelible marking, the trade name or trade mark and the batch number of the manufacturer of the blank in the left front bottom corner, in a space of height approximately 5 mm and of length approximately 50 mm.

**7.3** A trade association mark may also be incorporated as per 7.2.

**7.4** Expiry decal.

**7.4.1** When required by legislation the front surface of the plate shall permit the application of a retro-reflective expiry decal, size approximately 10 mm x 40 mm.

**7.4.2** If applied, the expiry decal shall be affixed on the bottom right hand corner, with the right hand border not more than 100 mm from the border of the plate.

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Figure 1 — Shapes of 75 mm high letters and numerals — FE font

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Figure 2 — Shapes of 75 mm high letters and numerals — FE modified font

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Figure 3 — Shapes of 60 mm high letter and numerals — FE modified

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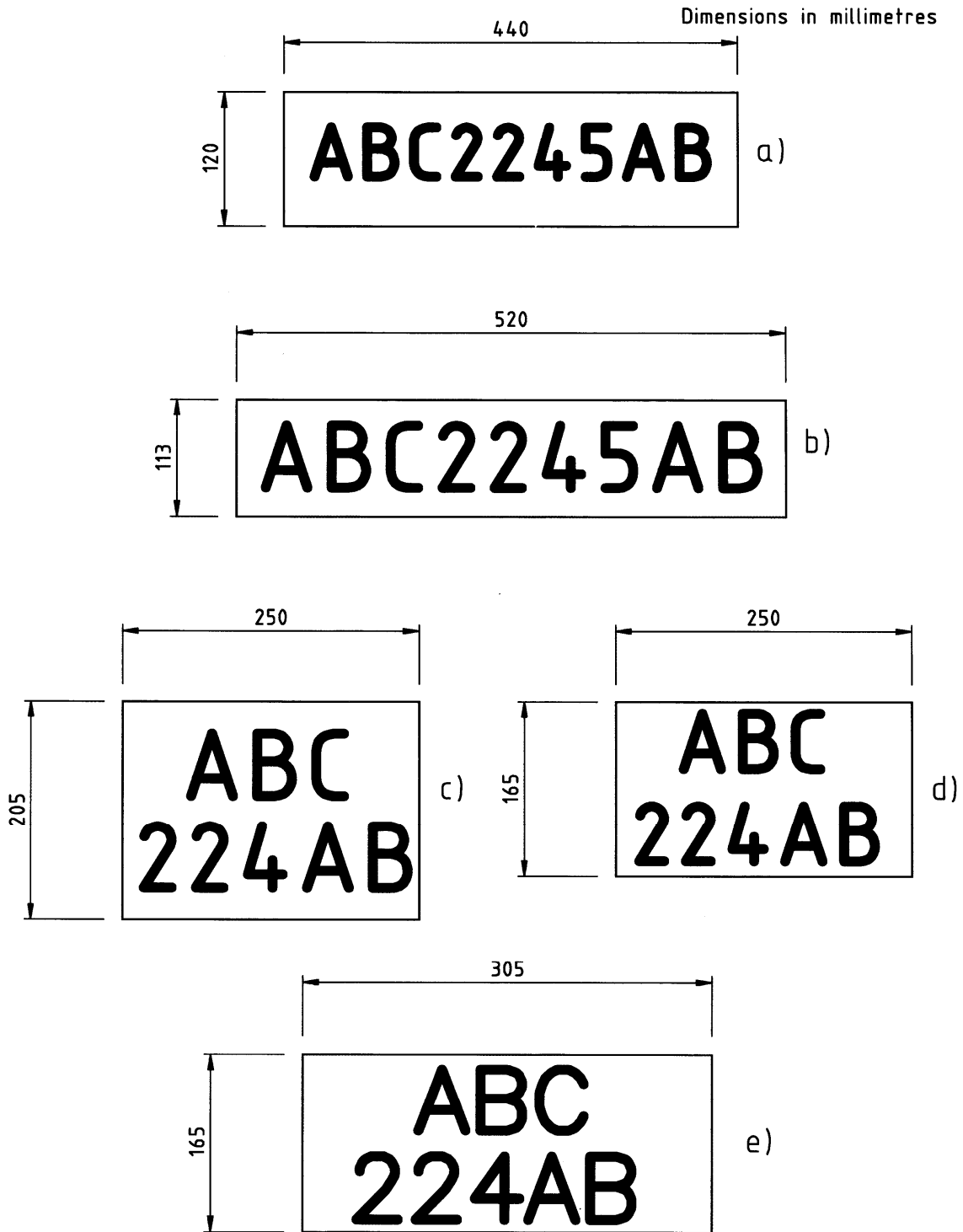


Figure 4 — Examples of layout of licence marks

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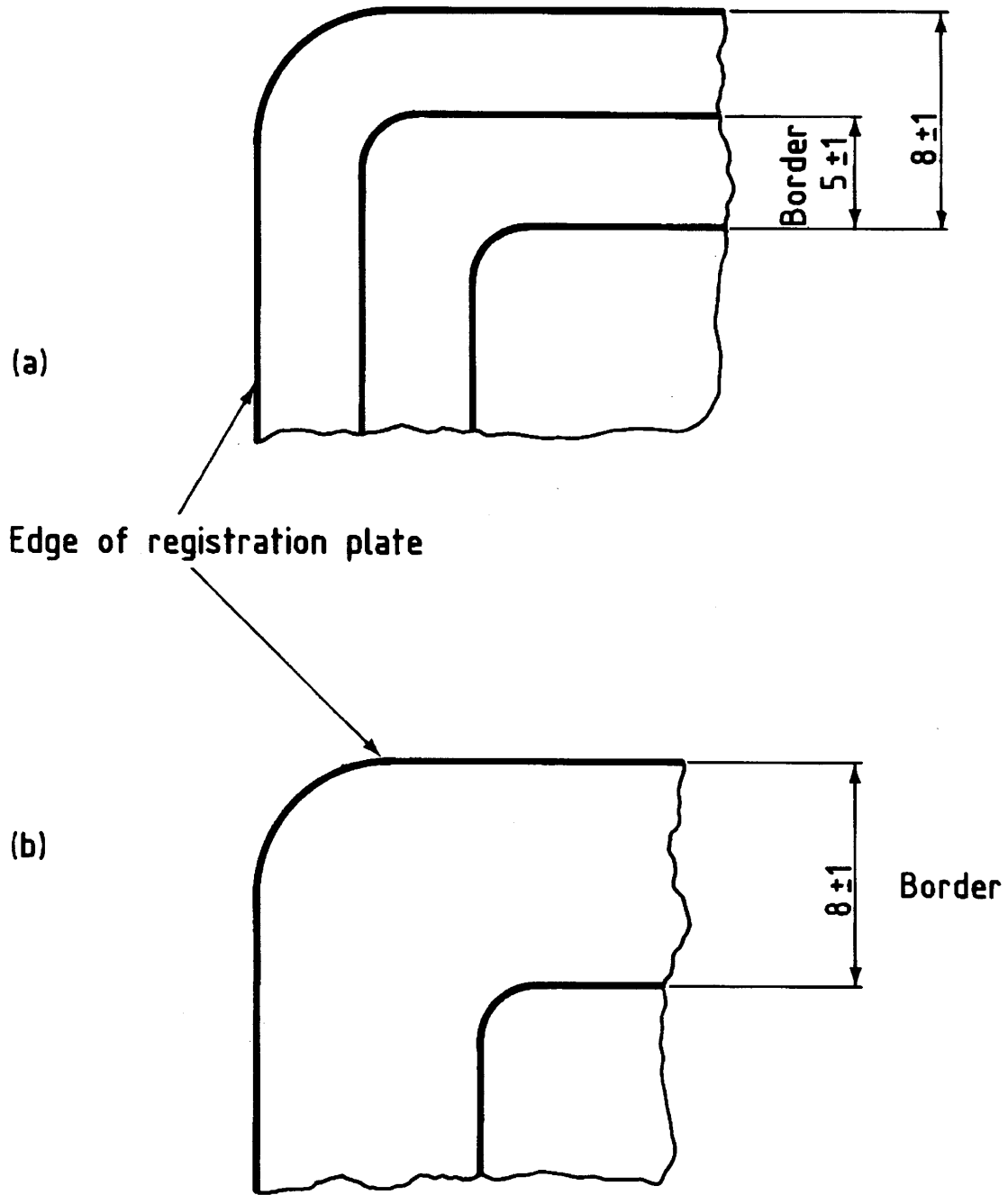
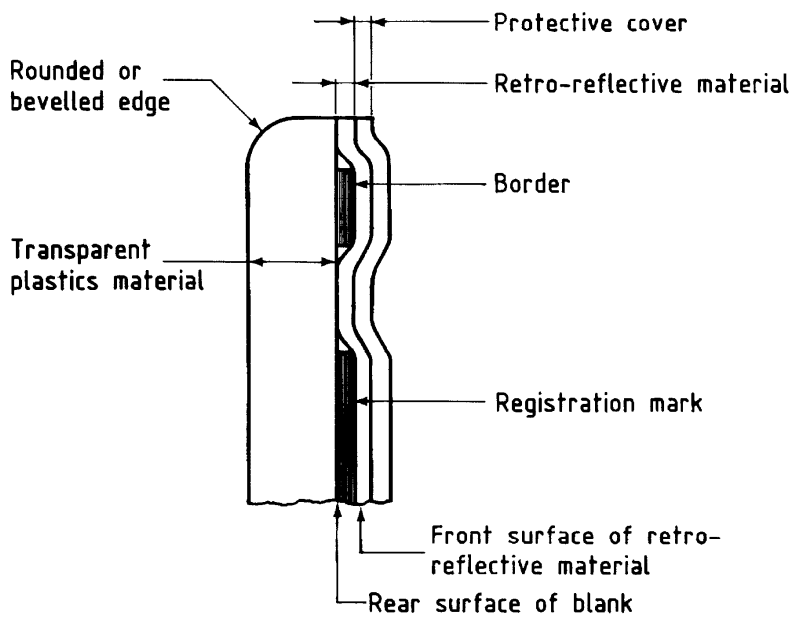
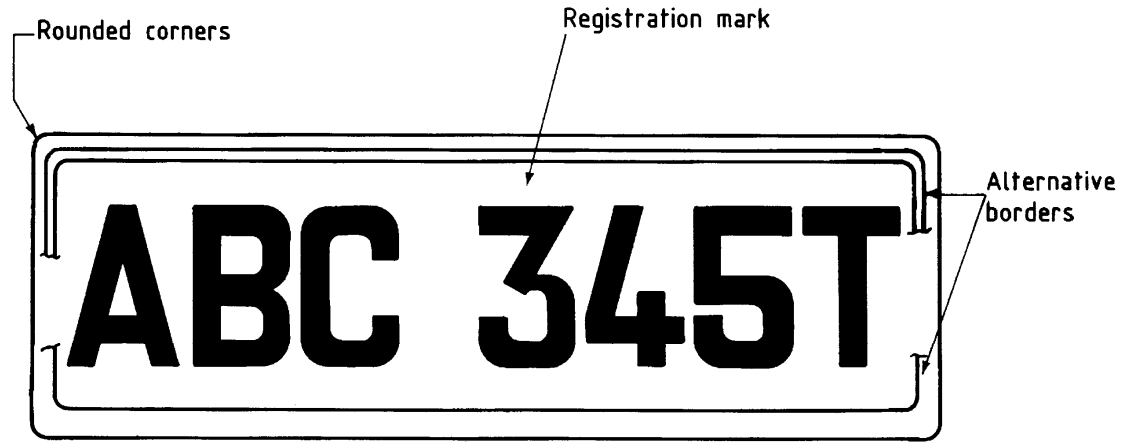


Figure 5 — Borders for registration plates

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Enlarged side view detail

Figure 6 — Details of registration plate

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